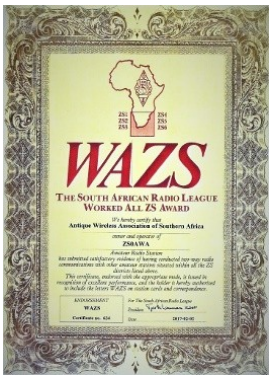
Antique Wireless Association of Southern Africa
Newsletter

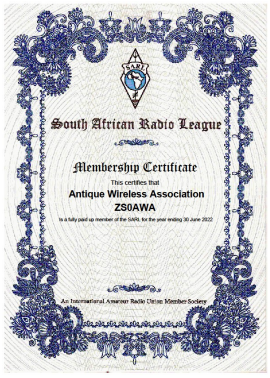
234 January 2026

AVO Mk1 Valve Characteristic Tester

1948: Mk1. In 1958 AVO acquired the Taylor company, who had the famous (and today very expensive) Taylor 45 tester. This particular tester already used the backing off method, to test for Gm. I don't know how they did that in terms of rights, but already in 1948 (when Mk1 was introduced) there was an improved version of the Taylor method used in the Mk1.To the Mk1, more or less everything was added, they could possibly observe on the market, and it was a real break through. Things like: Leakage and shorts test same as Funke, separate heater voltage transformer same as Hickok, Anode Current test same as Neuberger, A Quality Test, later included as 'English Test' in many Hickoks, a safety relay with three functions, and probably I forgot to list a few features too. Socket pins were numbered by the normal standard, they put almost every tube socket in there, which possibly excited, and the comfortable roller switch makes operation quick and easy. There is even room to add one or two extra sockets.

The AVO Mk1 was the best tester available when it was introduced, and even today it is a very desirable machine to own. The German word for such a product is an egg laying wool milk pig. You can take excellent advantage of everybody screaming like mad, to buy a Mk4, because Mk1/Mk2 is a wonderful machine just as well, and it had many specific differences with later Mk3/Mk4, which are not disadvantages.





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AWA Committee:

* President—Chris ZS6GM
* Vice President—
* Technical Advisor—Rad ZS6RAD
* Secretary/PRO—Andy ZS6ADY
* KZN—Don ZS5DR
* WC—John ZS1WJ
* Historian— Louis ZS6SK
* Members—Renato ZS6REN Wally ZS6WLY

Reflections:

Well, it looks like you all made it through the Christmas rush and Into the new year. Many have gained a few pounds or a few inches (cm) around the waist and have come back with New Year resolutions to try and never over indulge again like that.

To those who did manage to restrain themselves, well done. We are proud of you. Noddy badges will be handed out in the near future.

At this time as we head into our 23rd year of uninterrupted service, we would like to thank all of you, as our loyal members, who have supported us in so many different ways.

In the beginning, there were those who said we would never be able to survive having no membership fee, even if our costs were minimal. Of course they were wrong, but only because there were those who took on themselves to see that we always had enough in donations to financially stay alive and pay for the things needed like our membership to the SARL, our annual licence fee, our website etc. These donations came in the likes of cash and radio's/equipment, that we were able to sell off at flea markets. Of course we can feel quite proud that we have managed to do this with your assistance and never had to ask for any additional funds.

We are always grateful for the time and effort that goes in to running things in the AWA. Our Saturday morning nets, the relays, the time offered up for running tables at flea markets etc. These are all things that just make it so good to be part of it all.

We certainly hope that this year will see some changes in propagation and also give you, our members, more time on air. We also hope that this will be a good year of restoration for you with so many opportunities out there of rigs that are just waiting to get back on frequency again.

With all that is going on around us in these times, I understand this may be a daunting task for some, but that sanity will prevail and your stations will glow with warmth and that RF will be directed around the globe to find a place to settle and bring you many QSO's.

May this certainly be a greater year than previous ones filled with good health and strength for what lies ahead in the days to come.

We look forward to hearing many more of you on our nets, on the Telegram group and any other way you can think of.

I do believe that this year can turn out to be a great year with a litle bit more enthusiasm from all concerned. It doesn't take much to get involved with the things on our agenda. For instance the Saturday visits to the SAIEE. It would be so good to see a few more faces there with the opportunity to operate from the club station. It doesn't take much to get there and the Museum is quite central to most of the areas.

Everyone loves going to flea markets and there are quite a few that are also quite accessible, as well as the bargains one can pick up at so many of them. Renato and myself would love to see you there for a chat.

Then there is the upcoming CW contest hosted by the AWA. I know this is not everyone's cup of tea, but then it does draw several of the CW ops out of their cupboards. How many CW contacts have you got listed in your log book ?

Then later on there is the revised AWA QSO party, with categories for all to participate in. Download the SARL Contest Manual and diarise the dates. We don't ask too much of you to join in the festivities, after all, it is your hobby.

Keep the candle burning and lets hope to see more of you during the year.

All the best for 2026. long may your valves glow in the dark and bring life to the ether.

Best 73

Andy ZS6ADY

Chris's Musings

January 2026

A new year is upon us. This means it's time for new beginnings providing new opportunities.

One of those opportunities has come about, almost by the finger of fate. I'm talking about the AWA website and document repository. The website and hosting were current and very effective when originally built. If one tracks the international traffic and referrals one can see how the AWA impacts the world. Thanks to many of our members, the AWA has been extremely successful in propagating technical news and providing a source for historical and technical documentation. Unfortunately, whilst modern technology provides us ready access to vast amounts of information from all over the world, its fast-moving updates and improvements mean that the software and hardware driving the 'machine' is also ageing much more quickly and sometimes it's hard to keep up. Particularly for small volunteer staffed organisations such as ours. And so the inevitable happened. The underlying website software was no longer supported and came to the end of life. We have been fortunate that Jacques, ZS6JPS out of his own resources has facilitated updates and maintenance over the last few years. But even he has not been able to keep up.

What does this mean to the AWA? Well, I get back to what I said earlier, we have a fresh opportunity. The AWA website and repository will need rebuilding on a new platform. This is not a trivial task. Members may ask why don't we have volunteers do the job? In my experience, a task of this nature requires full time commitment and more importantly the time and resources to maintain and update the site. The answer is to employ a web design company with the necessary skills and resources with contracted performance goals. This takes money, but at least the project will be completed in a contracted time scale and there is accountability. And then, the big question is how does the AWA pay for this? Hopefully some our wealthier members are able to contribute to the cost and we have a golden opportunity to design the new site to accommodate advertising. And of course, if you donate surplus equipment, this can be sold and the funds put towards the AWA web presence. I need not say more strongly that the most important assets of the AWA are its members and its extensive technical archive.

If you have business or commercial contacts who may be prepared to advertise or make a donation, please get in touch with Andy, ZS6ADY.

Overview of the State of the AWA Website

There have been many questions, and a few complaints about the disappearance of the AWA SA website. So here is a quick status report.

Background

The AWA SA website was last upgraded around 2018, that's almost ten years ago. Since then the web has moved on and the version of the *Joomla* content management system on which the AWA site was based has been discontinued and is no longer supported. Additionally many of the security features needed to keep the site and member information safe are also no longer supported. Because most of the features and functions are no longer supported or upgradeable and the fact that spam attacks have drastically increased over the past two years, means that it has become impossible to maintain the AWA web presence. As an interim measure, in March 2025, a generous spon-

sor provided some money to keep things going, but in December 2025 following a number of attacks and denial of service it would have been delinquent to leave the website ‘on-air’.

The Way Forward

Behind the scenes, the web developers have been busy retrieving and archiving the invaluable archive material in order to provide the basis for a brand new, ‘fit for purpose’ web presence. Under the eagle eye of Jacques ZS6JPS, research is well under way to find the most cost effective but robust Content Management System. A few basic requirements are; long term stability and support, ease of maintenance and upgradability, safety of member information and data integrity.

It will be a few months before a new site can be commissioned but the emphasis is on doing the job properly the first time around. We ask for your patience while we get on with the job. And, because we will be using a professional web development company, the developer will be held to account on delivery and functionality.

Heathkit Equipment / Archive PE1GVK

When the anguished tones of the Elvis Presley recording suddenly faded from the speaker in my workshack, I knew company was coming - most likely with the usual pot of coffee and a consuming curiosity. Calmly, I made a few last adjustments on my latest electronic triumph and awaited the judgment committee of one.

It took her exactly three minutes and twenty seconds to turn off the record player in the music room, stop in the kitchen for the coffee, walk from the house to my workshack and knock on the door.

"Couldn't stand any more of that male Banshee's adenoidal wailing, eh?" I said, admitting the wife into my private sanctum of scientific puttering. "Why you bought those absurd recordings is completely beyond -"

"It happens," she said coldly, "I like his singing."

"If that's singing, let's go down to the dog pound and hear some group stuff some time," I snickered. "I've heard better tonality from Air Alert Sirens and I -"

"What in the world is that?" She pointed to my newly built project on the floor.

"Oh, that happens to be the little marvel which is only going to walk off with all the awards when my R/C Plane Club holds its Competitive Meet next week," I said casually. "When they see this baby -"

"First plane I ever saw without wings."

"It's a whirlybird type - you know, helicopter." I ran a fond hand over its smooth fuselage. "Whole thing only weighs twenty pounds, including the modified, aluminum-cast lawn-mower engine which powers it. It carries a quart tank of a special fuel, which I got from the kids who run the hotrod strip on the edge of town, and it can stay airborne for almost an hour, according to my calculations. "

"How do you steer it ?" she asked.

"With R/C control of these adjustable blades on the larger rotor." I smiled into my coffee. "My tone control system modifications - somewhat along the line of what would be conventional elevator-control - are something a notch below sheer genius! According to my schematics, this baby'll -"

"You keep saying 'according to your plans,' " she said skeptically. "That means you haven't actually flown this misbegotten gizmo yet." An expression of mingled worry and suspicion flooded her face. "How do you know it won't go berserk - like some of those other nutty R/C nightmares you turned loose ?"

"Impossible!" I chuckled. "I've checked this baby out so thoroughly - both electronically and mechanically - that only a windstorm could make it act erratically!"

"I envy you your confidence," she said.

"You'll see," I promised, picking up the rather large model and carrying it outdoors. "Why, even a mor - uh ... even you could fly this little gem! And to show you how sure I really am, I'll let you have the pleasure of piloting its test flight!"

Carefully placing the helicopter on the lawn, I set about starting the modified mower motor. A moment later, it exploded into action and I stepped out of the range of the three-foot-long rotor-blades which began slashing efficiently in a blurred orbit above the helicopter. I hurried over to the wife. She clutched the transmitter unit nervously, her eyes held to the helicopter with anxious fascination.

"It's running in neutral now," I told her. "Punch that button marked Up."

She did and the pint-sized whirlybird slowly, smoothly rose from the ground. Two feet ... five feet ... eight feet ... higher and higher it climbed, revolving in a circle as it ascended, the rotors screaming noisily. "Now, correct that revolving motion - punch the Forward button," I shouted. "It cants the blades sufficiently to tilt the helicopter into a forward position!"

She jabbed the button, desperately, and the little whirlybird began slowly flying across the yard.

"See!" I yelled. "It goes just like the real thing!"

"Here, you take it!" she screeched nervously, holding out the transmitter unit to me. "I - I don't w - want to r - run it a - any more! Take it!" Without warning, she all but threw the transmitter at me. I grabbed for it, missed, and the unit smashed to the ground. Frantically, I snatched it up.

It rattled ominously.

"Why did you do that ?" I yelped. "I think you've busted something!" Gently, I shook the unit again. It rattled all right.

"Look at the gizmo!" she screamed.

Above us, the helicopter suddenly shot upwards about thirty feet, tilted to the starboard and shot off across the rooftops. Twice, before it flew out of sight, I

Without warning, she all but threw the transmitter at me. I grabbed, missed, and the unit smashed to the ground. "Why did you do that?" I yelped ...

DRAKE MODEL DSR-1 COMMUNICATIONS RECEIVER

FEATURING . . .

- **Continuous coverage 10 kHz to 30 MHz**
- **Digital synthesizer frequency control**
- **Frequency displayed to 100 Hz**
- **All solid state**
- **AM, SSB, CW, RTTY, ISB**
- **Series balanced gate noise blanker**
- **Rack or desk mount**
- **Price $2195.00**
- **Accessories available to accommodate specific requirements**

SPECIFICATIONS • **Frequency Range:** 10 kHz to 30.0 MHz. • **Modes of Operation:** USB, LSB, CW, RTTY, AM, ISB. • **Frequency Readout:** Complete to 100 Hz on six NIXIE tubes. • **Frequency Selection:** 10 MHz, 1 MHz, 0.1 MHz switch selected; 0 to 0.1 MHz continuously variable. • **Frequency Stability:** Drift does not exceed 150 Hz in any 15 minute period with a temperature change of 7° C per hour over a range of 0° to 40° C. • **Sensitivity:** Less than 0.5 microvolt for 10 dB SINAD at 2.4 kHz SSB mode; Less than 1.0 microvolt for 10 dB SINAD at 6 kHz AM mode. • **Image Rejection:** Greater than 70 dB relative to 1 microvolt. • **Blocking:** Greater than 100 dB relative to 1 microvolt. • **Cross Modulation:** Greater than 90 dB relative to 1 microvolt. • **Intermodulation:** Greater than 80 dB relative to 1 microvolt. • **Opposite Sideband Suppression:** Greater than 60 db at 500 Hz into the opposite sideband. • **I.F. Bandwidth:** 6 kHz, 2.4 kHz, 1.2 kHz, 0.4 kHz; Selectivity @ −6 dB: 6 kHz, 2.4 kHz, 1.2 kHz, 0.4 kHz; @ −60 dB: 11.5 kHz, 4.3 kHz, 2.4 kHz, 0.8 kHz; Optional filters available for other bandwidths. • **I.F. Outputs:** 50 millivolts into 50 ohms at 1st I.F.; 5.05 MHz and 2nd I.F. 50 kHz. • **Automatic Gain Control:** Audio Output rises less than 3 dB for RF input change of 1 microvolt to 100 millivolts; Attack time 100 microseconds; Release time 750 milliseconds (Slow AGC), 25 milliseconds (Fast AGC). • **Antenna Input Impedance:** 10 kHz to 500 kHz, 1000 ohms; 500 kHz to 30 MHz, 50 ohms. • **Audio Output:** 3 watts at 5% maximum distortion into 3.2 ohm load; 1 volt into 600 ohm output line; 3.2 ohm unbalanced and two 600 ohm balanced outputs; ISB output is one of the two 600 ohm balanced outputs. • **Audio Hum and Noise:** Greater than 60 dB below rated output. • **BFO:** Derived from standard clock or variable over a ± 3 kHz range from front panel. • **Power Requirements:** 115/230 volts ± 10% single phase 50-420 Hz 15 watts; 12 or 24 VDC supply optional. • **Dimensions:** 5.25 in. H x 19 in. W x 15 in. D, (13.3 cm H x 48 cm W x 38 cm D). • **Weight:** 17 lbs (7.7 kg).

Available November . . . see your Dealer

R. L. DRAKE COMPANY
540 RICHARD ST., MIAMISBURG, OHIO 45342

More Details? CHECK–OFF Page 94

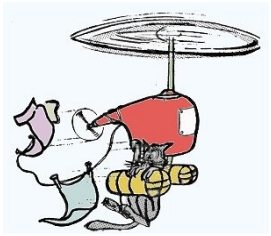
saw it drop to within three feet of the ground, whip around in crazy maneuvers, and then steadily climb back into the sky. Now its clatter was fading into the distance. We stared, horrified, as it zoomed behind a row of trees several back yards away.

"I knew it! I knew it!" wailed the wife. "I just knew it would happen! Every time you start fooling around with these darned R/C -"

"Who dropped the transmitter?" I snapped savagely. "Come on, we've got to chase that baby and try to figure a way to catch it before -"

Somebody - or something - screamed quite distinctly about half a block away. It was enough to curdle one's blood, that scream ... especially if one happened to be responsible for letting a helicopter with three-foot-long blades loose in the neighborhood. Breaking into a gallop, I wondered how many years I'd get and if the wife would wait for me.

Suddenly the whirlybird appeared - chopping furiously across an empty lot, about ten feet off the ground - and veered sharply to port. I tried to head it off, but it climbed - just as I leaped, hoping to grab a pontoon - and chattered past me. Before I landed on my aching back I caught one short glimpse of a large and scrawny tomcat clinging to a pontoon, his yellow eyes blazing with madness. I hoped he accounted for the unholy scream.



Suddenly the whirlybird appeared - a large and scrawny tomcat clinging to a pontoon ...

"It went into Mrs. Millar's place!" babbled the wife, helping me to my feet. "Did you see that cat riding -"

"Saw it!" I agreed, and sprinted at a dead limp into the Millar yard. Ahead, I could hear the rise and fall of the mower-engine, its pitch changing. It's too much to hope for power failure, I thought, as I raced through a small vegetable garden, vaulted a fence and continued through somebody's roses, ignoring my wounds. That baby's good for another forty minutes, and when I think of the damage she can do in forty minutes ...

I turned off the thought.

Again, suddenly, chillingly, somebody screamed with terror. I emerged into a back yard to see a matronly woman, her face blanched and twisted with fright, staring into the air. Twenty feet above her, flying in a wide circle and trailing a clothesline with several flapping items on it, was the errant helicopter - its motor snarling and coughing with almost vicious glee.

"Don't be alarmed, lady!" I gulped. "I'll try to -"

Just then she buried her head in her arms and mercifully passed out.

The whirlybird now widened its circle and I saw that it went by the limbs of a tall apple tree in the next yard with regularity. A desperate, unlikely idea popped into my mind. I streaked for the apple tree and began clambering up it. The helicopter passed twice before I made it to the limb which reached far out over the back yard.

"Think you can grab it as it comes by ?" yelled my wife, watching tensely below. "Here it comes ... "

Balancing precariously on the unsteady limb, I readied myself to make one grab, which had to be successful, as the helicopter chopped by me. It was slowly gaining altitude again, and if I missed it - the whole plan was shot. Then, the plane was within reach and I grabbed for it ... missed ... lurched recklessly forward ... grabbed again, getting the starboard pontoon and a faceful of frenzied cat ... was pulled completely off the limb - and went hurtling earthward.

The impact was horrendous, but I heard the blades snapping off and the motor dying before I sank into gathering darkness.

I came around to find myself sprawled in the wreckage, with a large and scrawny tomcat calmly cleaning his paw beside me and two people standing over me. As my head cleared, I recognized my wife and old Mr. Dixon, owner of the apple tree.

"Listen, young feller," said old Mr. Dixon softly, "You're kinda old for them kid stunts. After this, if you want an apple - just ask for it."

Neither of us uttered a word - taking the back-alley route home - until we were safely within my workshack again. Sadly, I regarded the shattered remains of what had been a stupendous project. Tenderly, I fingered the twisted, devastated chunks of helicopter.

The wife put an arm around my shoulder.

"Buck up, boy! Dismiss this whole thing from your unpredictable little mind and let's go downtown!" She smiled strangely.

"Downtown?" I murmured brokenly.

"Sure! We'll buy one of those tremendous R/C boat kits! The biggest and best one we can find!"

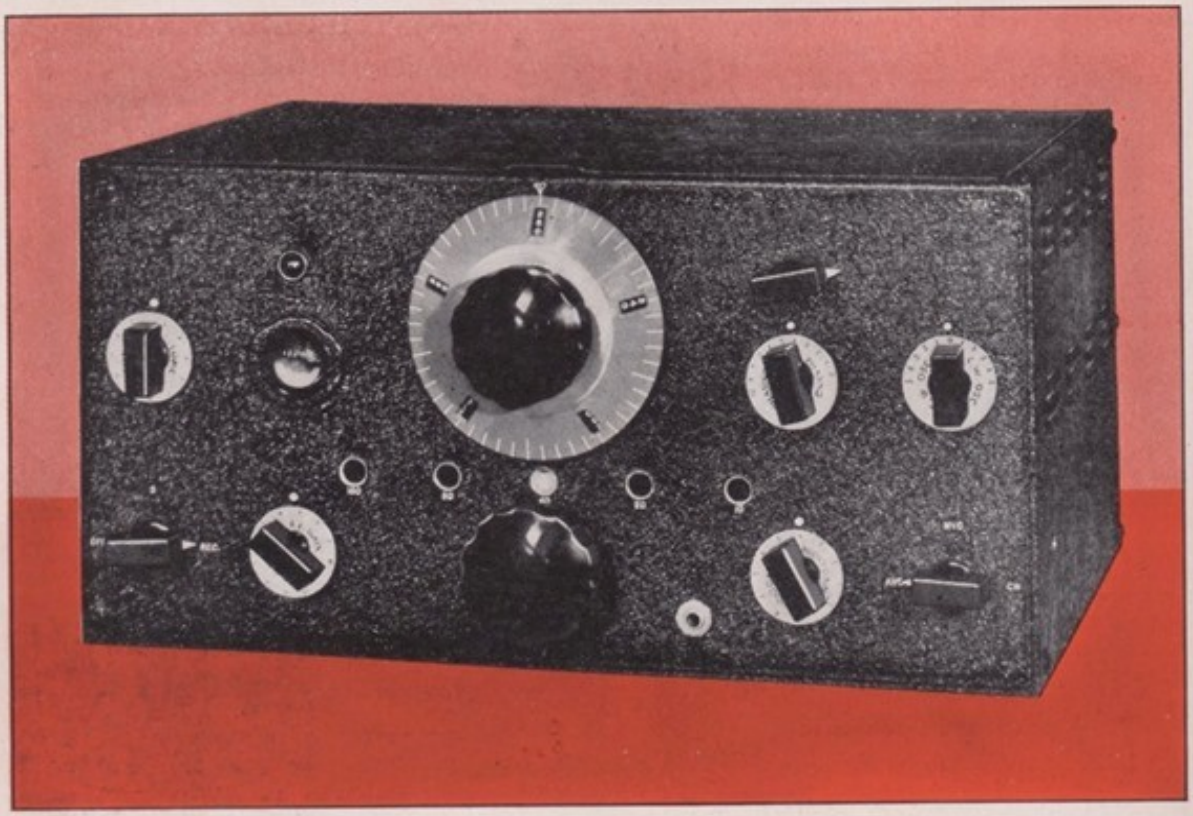
"A - After what I've done ?" I moved slightly away from her, wondering how my fall could affect her head. "You'll buy me an R/C boat kit despite all this ?"

"You bet!" she said, a determined look whipping over her face. "You're grounded, boy! From here on out, you're strictly water-borne! After all these hectic years, I know better than to try and cure you of these R/C spasms. But I can modify the results! Come on. I'll even buy you a yachting cap to go with it."

That was quite some time ago and I've got the five-foot model of a Navy PT Boat almost finished. The modified mower engine fits fine, and I'm really going to wow those characters down at the R/C Boat Club. I cut quite a figure in that yachting cap.
Call me Commodore.

[442 CATALOG SECTION]

NATIONAL *High Frequency* RECEIVERS



NC-101 X RECEIVER

Built and designed strictly for the amateur bands, this receiver provides all the necessary features required by this highly specialized field.

Since only these relatively narrow bands are covered, more efficient coupling between high frequency stages is possible which results in greatly improved image ratio and performance at high frequencies over the conventional all-wave receiver. One R.F. and two I.F. stages are employed in the 12 tube circuit which includes the 6E5 tuning indicator tube. The Lamb Single Signal crystal is standard equipment. Separate controls are provided for Selectivity, Phasing, R.F. Gain, Audio Gain, Tone, C.W. Oscillator and AVC.

Quick band change is effected by the same unique coil shifting mechanism as used in the NC-100. Each of the five Amateur bands are spread over 400 divisions on the Dial of the ever-popular PW Condenser. Special S.F.L. condenser plates, double spaced, insure exceptionally low temperature drift. The receiver (self contained except for the speaker) may be readily converted for relay rack mounting with the brackets listed below.

A 10 tube — 6 volt battery model is available with a 10" permanent magnet type of dynamic speaker and differs from the A.C. model mainly in that the power supply is eliminated and only one output tube is used. Power output of A.C. model — 10 watts; Battery model — 2 watts.

FEATURES

- **FIVE BAND SPREAD RANGES**
  - **1.7– 2.0 Megacycles**
  - **3.5– 4.0 Megacycles**
  - **7.0– 7.3 Megacycles**
  - **14.0–14.4 Megacycles**
  - **28.0–30.0 Megacycles**
- **STRICTLY SINGLE CONTROL TUNING**
- **AUTOMATIC PLUG-IN COILS**
- **PERMANENT CALIBRATION**
- **MICROMETER DIAL**
- **TUNING INDICATOR**
- **AMPLIFIED, DELAYED AVC**
- **CRYSTAL FILTER**
- **C.W. OSCILLATOR**
- **TWO I.F. STAGES**

NC-101 X Receiver — complete with tubes and 10" speaker chassis.
A.C. Model. **List Price, $215.00**
Battery Model. **List Price, 200.00**

RRA Relay Rack Adapters designed for mounting any of the NC-101 X Receivers in a standard relay rack.
List Price, per pair, $2.50

DCS Metal Cabinet for 10" Speaker, same finish as receiver.
List Price, $8.50

NATIONAL COMPANY, INC., MALDEN, MASS.

An engineering bulletin describing the above receivers in detail will be mailed on request.

Antique Wireless Association CW Activity Day

The AWASA http://www.awasa.org.za/

1. Aim
The aim of the CW Activity Day is for participants to contact as many amateurs as possible on the 20, 40 and 80 m amateur bands.

2. Date and Time
13:00 – 15:00 UTC on the 1st Sunday of February - 1 February 2026.

3. Frequencies
14 000 to 14 060 kHz
7 000 to 7 040 kHz
3 510 to 3 560 kHz

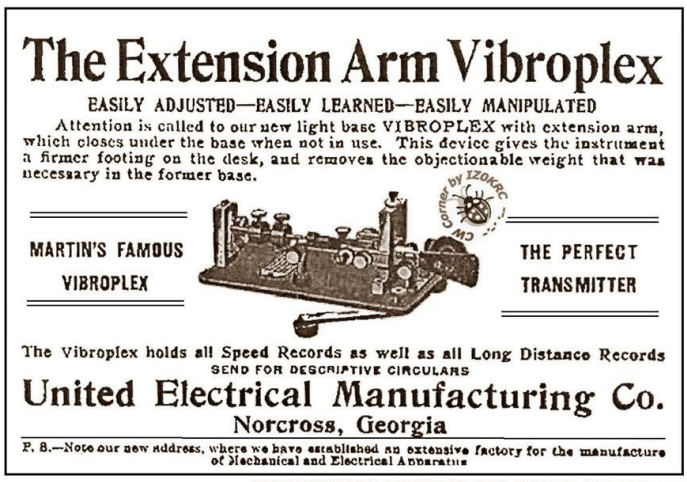
4. Categories
4.1. Single Operator All Band, Low Power (maximum 100 W)
4.2. Single operator All Band, QRP (maximum 5 W)
4.3. Single Operator Single Band, Low Power (maximum 100 W)
4.4. Single operator Single band, QRP (maximum 5 W)

5. 5. Exchange
5.1. RST, operators name and Grid Square locator
5.2. Each QSO claimed for competition credit must comply with the rules found under General Rule “5. Contacts”.

6. Scoring
Contacts count 1 point for low power, 2 points for QRP.

7. Awards
Certificates are awarded to the first places and the highest single band score.

8. Log Sheets
Log sheets must be submitted by 21:59 UTC Friday 6 February 2026 to



THE COMMERCIAL TELEGRAPHERS' JOURNAL, NOVEMBER 1907

How Do Valves Work ?
By Paul Stenning

To those of us who have been brought up with transistors, valves can seem unnecessarily complex. On this page, I will attempt to explain the workings of the valve in a clear simple manner - without the atomic theory and the maths!

A Brief History Lesson

In 1883, Thomas Edison was experimenting with electric lamps. In his early experiments, the glass bulb was becoming dull, and he wondered if this was due to particles being given off by the filament. He fitted a metal plate inside the bulb to attract these particles, and found that if the plate was at a positive potential a current would flow from the filament.

Later Professor Flemming found that current only flowed when the plate was positive, and that the arrangement could be used to rectify an alternating voltage. He patented this in 1904.

Lee de Frost then discovered that, by placing a wire between the filament and plate, the current could be controlled. Thus he invented the Triode (or Audion as he called it) - the first ever electrical amplifying device.

Thermionic Emission

When a metal is heated to a sufficiently high temperature in a vacuum, it will give off electrons. These will be attracted to any electrode that is at a more positive potential.

Most metals will melt by the time they are hot enough to emit a significant amount of electrons. Tungsten is an exception, which gives good emission at 2300 to 2500 degrees Centigrade, and melts at 3380 degrees Centigrade. This would glow almost as bright as an electric lamp, which was a characteristic of early Bright Emitter valves. In later valves, the tungsten was coated with an oxide (such as barium or strontium) which gives good emission at around 700 degrees Centigrade.

In most valves, the emitting conductor is a separate component to the heating filament. The emitting conductor is known as the cathode, and is normally in the form of a thin tube. The heater passes inside the cathode and is electrically insulated from it. This is known as an indirectly heated cathode. Some valves have directly heated cathodes, where the heater and cathode are the same component. These were frequently used in battery sets.

Electron Flow vs Conventional Current Flow

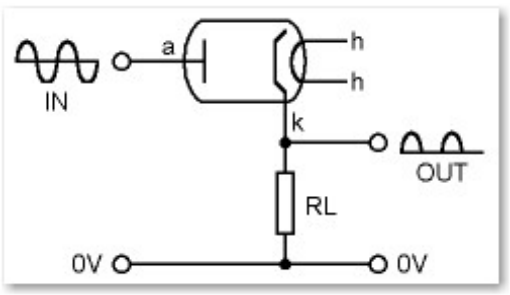
We are now used to thinking of current flowing from positive to negative. However current is actually a flow of electrons in the opposite direction. This anomaly is the result of an incorrect assumption by early scientists, which has become established - hence we have the separate terms Electron Flow and Conventional Current Flow.

To avoid confusion (hopefully!), think in terms of electron flow when considering the actual workings of the valve, and current flow when thinking about the circuit.

The Diode

The electron collecting plate is known as the anode. It normally consists of a cylinder of metal around the cathode, a few millimetres away.

When the anode is at a positive potential relative to the cathode, current will flow. This is useful for detection and rectification, but is obviously incapable of amplification.



A rectifier valve has larger, more substantial electrodes than a detector diode, to cope with the much greater currents involved. This diagram shows a rectifier valve circuit with an AC input and a half-wave rectified DC output.

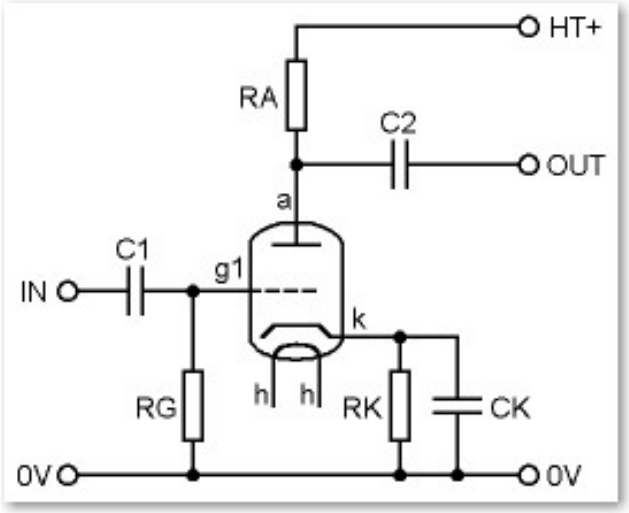
A smoothing capacitor would normally be connected across the load (RL) to give a relatively steady DC supply. The load would normally be the remainder of the circuit rather than a single resistor.

The valve electrodes are indicated by the normal abbreviations - a for anode, k for cathode and h for the heater connections. A heater supply is not shown in the diagram for simplicity.

The Triode

By adding a spiral of wire between the cathode and the anode, it is possible to control the current flowing between them. This spiral of wire is known as the control grid.

Referring to this diagram, if a varying signal is ap-



plied to the control grid (g1) via C1, the anode current will vary in sympathy. By placing a resistor (Ra) between the anode and the positive supply, the varying current will be converted to a varying voltage on the anode.

In normal use the control grid will not be at a positive potential relative to the cathode, otherwise it will act as another anode and draw current (known as grid current). It is normally biased a few volts negative (although some triodes are designed to be biased at 0V). In very early radio sets, a separate grid bias battery was used, often having several tappings to give different bias levels - but this was quickly superseded.

Usually cathode biasing will be used. Instead of connecting the cathode directly to ground (0V), it is connected via a low value resistor (Rk). This will drop a few volts, so the cathode will be a few volts positive. The control grid is at high impedance and draws virtually no current. It is normally connected to ground via a high resistance (Rg), and the signal is coupled via a capacitor (C1).

If Ck is omitted, the voltage at the cathode will vary with the anode current. This causes negative feedback which gives a reduction in gain (and also reduces distortion). Ck is fitted to obtain the maximum gain from the stage, and has a low impedance over the signal frequency range.

Triode valves are mainly used for low level audio amplification. Their use is limited at radio frequencies because of the capacitance between the control grid and the anode. Although this is only a few pF, the "effective capacitance" is approximately equal to this value multiplied by the stage gain. This effective capacitance becomes the input capacitance of the stage, and has a drastic shunting and detuning effect on a radio frequency signal.

The Tetrode

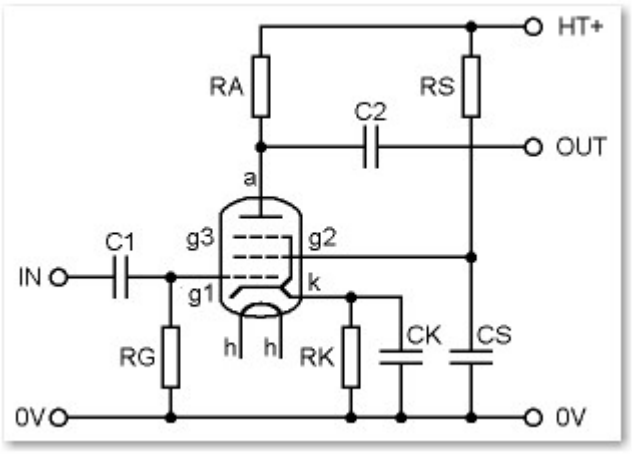
The tetrode was a development of the triode, designed to overcome this problem. A second grid is placed between the control grid and the anode. It is known as the screen grid, and acts as an electrostatic screen, the purpose being to minimise the capacitance between the control grid and anode.

For this to work it must be connected to ground at signal frequencies. If it were connected directly to 0V it would act as another control grid and greatly reduce the anode current. It is therefore often connected to the HT rail via a resistor to drop some voltage, and decoupled to 0V with a suitable capacitor.

The tetrode solves the capacitance problem allowing operation at high frequencies, and also gives greater gain. However, it introduces another problem - distortion. This is caused by secondary emission, which is too involved to describe in this brief article. Consequently the tetrode is seldom used, but it is included here because it is an important stage in the development of a better solution.

The Pentode

As its name implies, the pentode has five elec



trons. Four of them are the same as those in the tetrode, namely the cathode, control grid, screen grid and anode.

To suppress the secondary emission a further grid,

known as the suppresser grid, is added. This is normally connected to the cathode, sometimes internally within the valve envelope, otherwise a separate connection is provided.

The result is a valve that retains the advantages of the tetrode - high gain and operation at high frequencies - without the distortion. Pentodes are commonly encountered in RF and IF amplifier stages, and in amplifier power output stages.

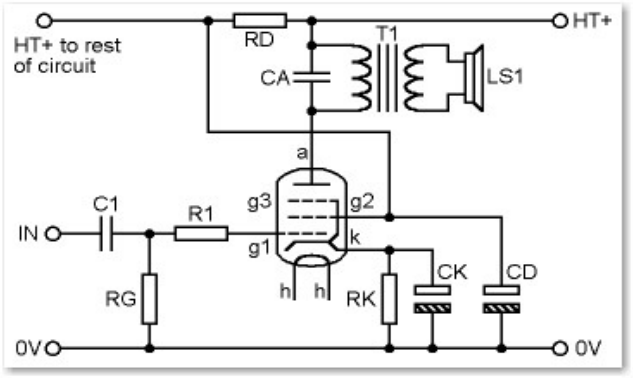
This diagram shows a basic pentode amplifier stage. This is fairly similar to the triode circuit discussed previously, with the addition of the connections to the screen and suppresser grids (g2 and g3).

Vari-mu Valves

It is often necessary to be able to control the amplification (gain) of a valve either manually or automatically. This is commonly required in the AGC (Automatic Gain Control) circuits in radio receivers.

To achieve this the spacing of the wires that make up the control grid are varied, being closer together at the centre and wider apart at the ends. By varying the negative voltage on this grid, the gain can be adjusted.

Pentode Power Amplification



This diagram shows a typical Class-A pentode out

put stage. The anode load resistor is replaced with the primary of the output transformer (T1), which drives the loudspeaker (LS1). The purpose of the transformer is to convert the relatively high anode impedance of the valve to the low impedance of the speaker.

Since the output transformer is inductive, its impedance varies with frequency giving an uneven frequency response. A capacitor (Ca) is often connected in parallel with the transformer primary, which corrects this to a great extent (this is sometimes referred to as tone correction). In some cases more than one capacitor is used, together with series resistors to give correction that is more accurate.

The screen grid (g2) is shown connected to the HT supply after a decoupling resistor (Rd). This is a common arrangement in valve radio receivers.

A resistor is placed in series with the control grid (g1). This works in conjunction with the input capacitance of the valve to attenuate the high frequencies (above the audio range) to ensure stability.

Many hi-fi amplifiers and some more expensive valve receivers use a Class-B push-pull output stage. This is an involved subject in its own right and will not be covered in this brief article. A higher quality output transformer is normally used in conjunction with negative feedback, which makes impedance correction capacitors (such as Ca) unnecessary.

Other Valve Types

A number of special-purpose valves have been produced with a greater number of electrodes. For example, Hexodes, heptodes and octodes (containing six, seven and eight electrodes respectively) are sometimes used in mixer-oscillator stages. The operation of these valves is rather complex and I will not attempt to describe them here!

Combined Valves

Often more than one valve section is contained in a single glass envelope. These sections normally share the same heater connections and are sometimes interconnected.

For example, the mixer-oscillator valve in radio receivers often consists of a hexode (or similar) and triode sections in the same envelope. The triode is used as the oscillator section and the hexode acts as the mixer and amplifier. The two sections may be connected internally within the valve, or externally.

Further Reading

Those requiring a more detailed discussion of valve operation are advised to refer to the book by Chas E. Miller entitled Valve Radio & Audio Repair Handbook.

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